Metacognition

Psych 248
4/17/12
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What accounts for differences in class performance?

Outline

- Study Choices
- Metacognition?
  - Monitoring Learning
    - Different cues people can use
  - Controlling Learning
    - Effectiveness of study decisions

How do students study?

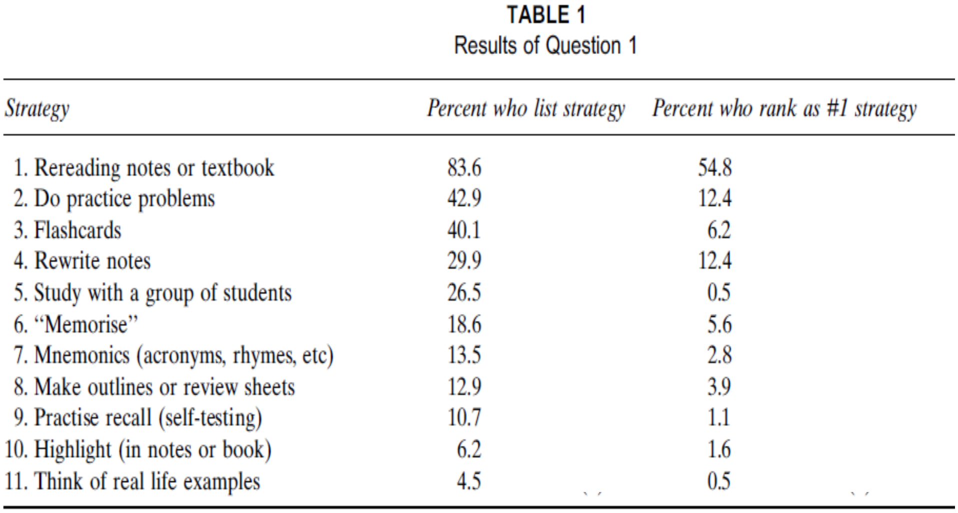
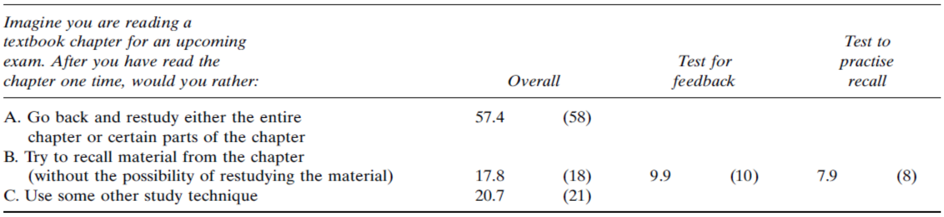


TABLE 1
Results of Question 1

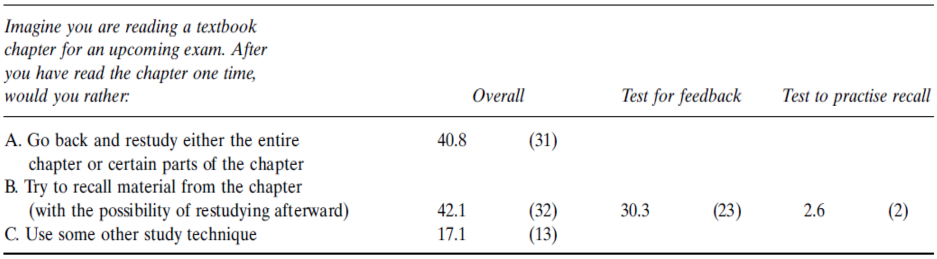
Strategy	*Percent who list strategy*	*Percent who rank as #1 strategy*
1. Rereading notes or textbook	83.6	54.8
2. Do practice problems	42.9	12.4
3. Flashcards	40.1	6.2
4. Rewrite notes	29.9	12.4
5. Study with a group of students	26.5	0.5
6. “Memorise”	18.6	5.6
7. Mnemonics (acronyms, rhymes, etc)	13.5	2.8
8. Make outlines or review sheets	12.9	3.9
9. Practise recall (self-testing)	10.7	1.1
10. Highlight (in notes or book)	6.2	1.6
11. Think of real life examples	4.5	0.5

Karpicke, Butler, & Roediger (2009)

Do people test themselves during study?



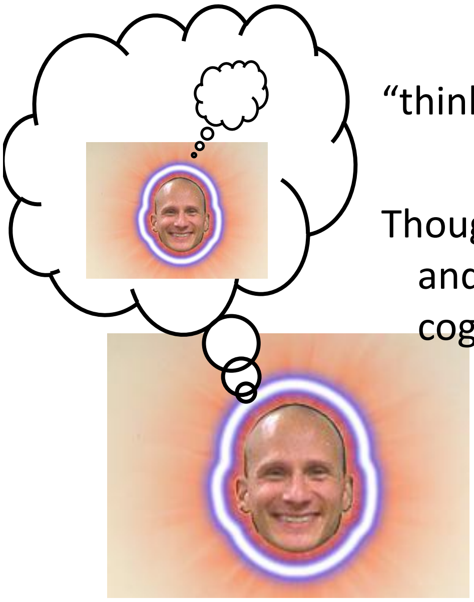
Imagine you are reading a textbook chapter for an upcoming exam. After you have read the chapter one time, would you rather:	*Overall*		*Test for feedback*		*Test to practise recall*	
A. Go back and restudy either the entire chapter or certain parts of the chapter	57.4	(58)				
B. Try to recall material from the chapter (without the possibility of restudying the material)	17.8	(18)	9.9	(10)	7.9	(8)
C. Use some other study technique	20.7	(21)				



Imagine you are reading a textbook chapter for an upcoming exam. After you have read the chapter one time, would you rather:	*Overall*		*Test for feedback*		*Test to practise recall*	
A. Go back and restudy either the entire chapter or certain parts of the chapter	40.8	(31)				
B. Try to recall material from the chapter (with the possibility of restudying afterward)	42.1	(32)	30.3	(23)	2.6	(2)
C. Use some other study technique	17.1	(13)				

Karpicke, Butler, & Roediger (2009)

What is metacognition?



"thinking about thinking"

Thoughts about one's cognition and how we control our own cognition

What is metacognition?

- Monitoring your cognition
  - “I’m not good at remembering names.”
  - “I don’t really understand conservation of momentum.”
  - “Elaboration helps me to remember more than rehearsal.”
  - “Benjamin helps me learn better than Tullis does.”
- Controlling your cognition
  - Turning off Justin Bieber so you aren’t distracted/horrified during study
  - Rehearsing someone’s name so you can pick them up later
  - Writing a shopping list so you don’t forget eggs

Why metacognition?

Monitoring → **Control** → **Performance**

You (hopefully) study outside of this class.
You control your own learning.
How you control (probably) makes a big difference in what you learn.

Plus, appropriate metacognition can help you succeed on game shows!!

Metamemory & how we measure it

	ACQUISITION	RETRIEVAL
Monitoring	Ease of learning judgments Judgments of learning	Confidence in answer Feeling of knowing
Control	Selection of processing Setting up a study schedule Allocation of study time Termination of study Choosing study activities Choosing items for re-study	Search strategy Termination of search

Metamemory- where is it?

- Where is metacognition present in the TV show Jeopardy?
- Where have we talked (incidentally) about metacognition in this class?

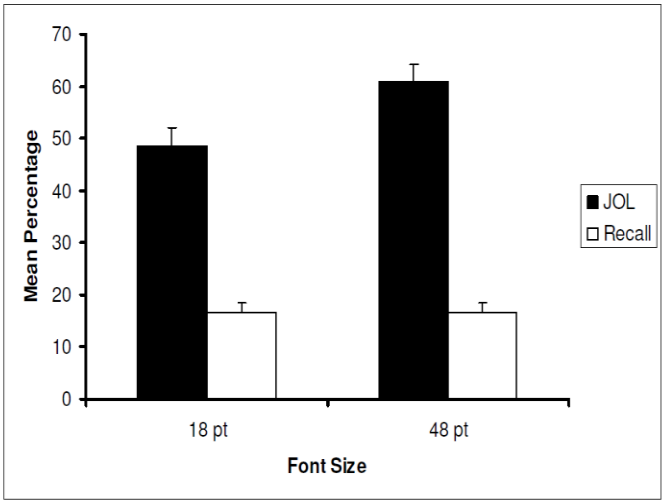
Outline

- Study Choices
- Metacognition?
  - Monitoring and control
- **Monitoring Learning**
  - **Different cues people can use**
- Controlling Learning
  - Effectiveness of study decisions

Rhodes and Castel (2008)

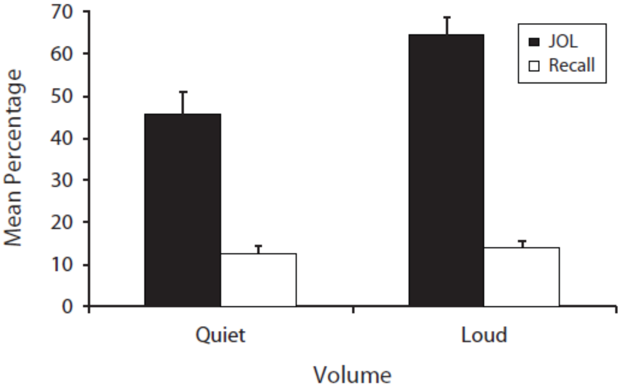
- Did what we just did
  - Subjects studied words in large or small fonts
- Gathered JOLs ("judgments of learning" - predictions of final memory performance) during learning
- Learners recalled items at the end of study

Metacognitive Cues



Rhodes & Castel (2008)

Metacognitive Cues



Study factors (even pure perceptual cues like font size) can influence metacognitive judgments without influencing actual memory.

Rhodes & Castel (2009)

Metacognitive Cues

- Learners *infer* how well they will know something
  - “I don’t watch daytime TV. I have a job.”
- Learners use a variety of cues to infer learning
  - (even when these cues don’t correspond to eventual memory performance).
  - Font size, loudness (perceptual cues: extrinsic cues)

Metacognitive Cues

- Metacognitive monitoring judgments based on weighted cues

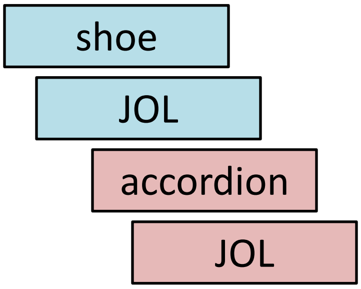
- Extrinsic Cues
  - Study characteristics (how you processed it, how much time you studied it, how many times you studied it, when you studied it, etc…)
- Intrinsic Cues
  - Item characteristics (concreteness, familiarity, etc…)
- Mnemonic Cues
  - Your personal interaction with the stimulus (were you primed?, what is the result of you testing yourself on it, etc…)

Shifting between types of cues: JOL and serial position

- Exp. 1

Subjects study 5 lists of words; each list has 15 items on it.

After studying each item, they make a JOL for the item.



shoe

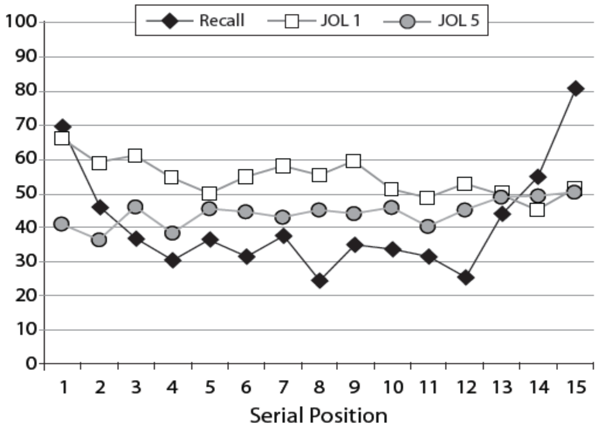
JOL

accordion

JOL

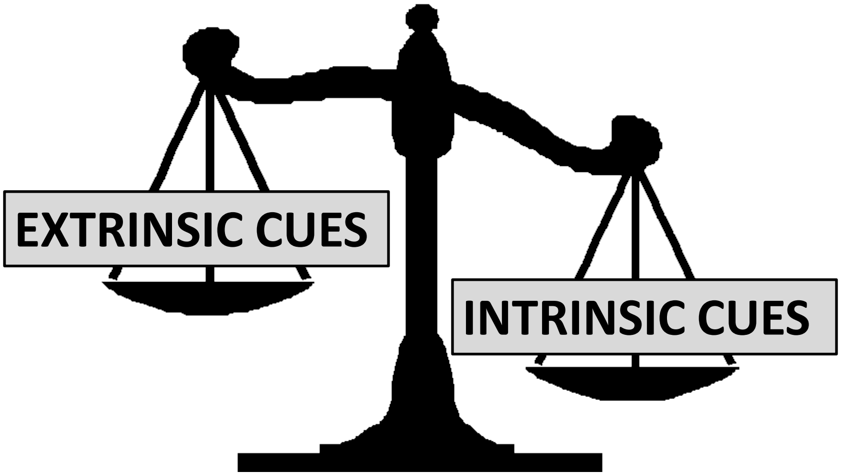
Castel (2008)

Shifting between types of cues: JOLs and serial position



Castel (2008)

Shifting between types of cues:
JOLs and serial position



Shifting between types of cues:
JOLs and serial position

- Exp. 2

  Subjects study 5 lists of words; each with 15 words. Subjects are given the list position for the word and asked to make a JOL before studying the word.

JOL #1

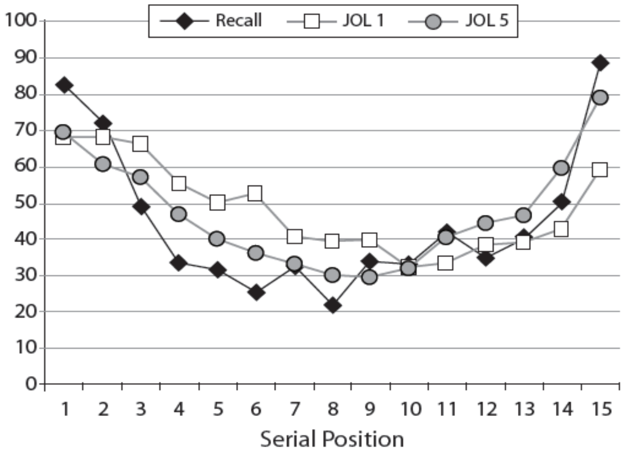
shoe

JOL #2

accordian

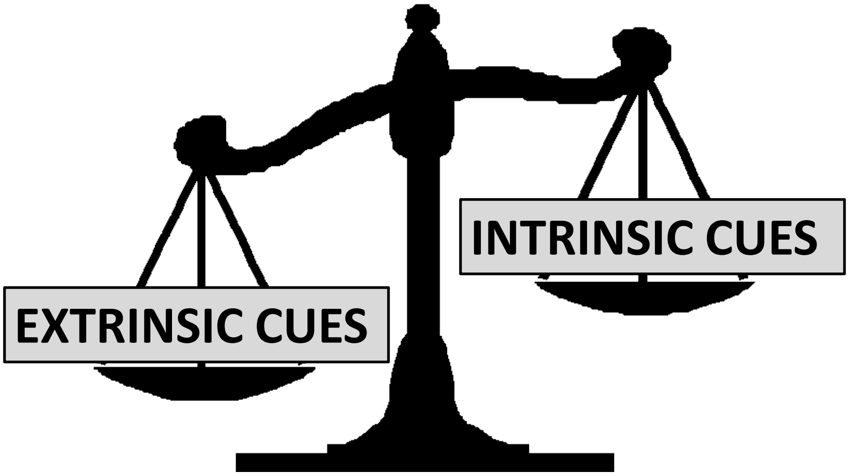
Castel (2008)

Shifting between types of cues: JOLs and serial position



Castel (2008)

Shifting between types of cues: JOLs and serial position



INTRINSIC CUES

EXTRINSIC CUES

How did you make JOLs?

- If given only the cue, you can try to retrieve the target.
  - If retrieval is successful, you rate it high.
  - If retrieval is unsuccessful, you rate it low.
- This is a *mnemonic* cue.

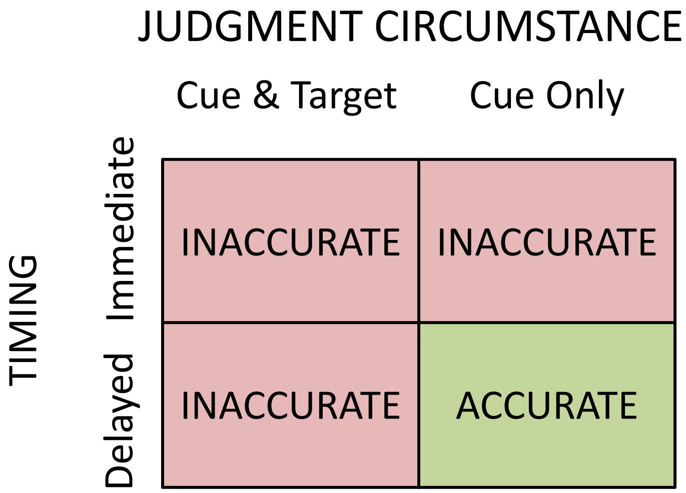
- If given both the cue and the target, you can't rely upon a diagnostic retrieval attempt (and must rely upon less accurate intrinsic and extrinsic cues).

Accuracy of JOLs

- What conditions promote accurate JOLs?
  - Ones that allow diagnostic retrieval attempts

- Which conditions allow diagnostic retrieval attempts?
  - Give you only the cue (not the answer)
  - Wait a little bit after you study it
- This has huge implications for how you study!

Accuracy of JOLs

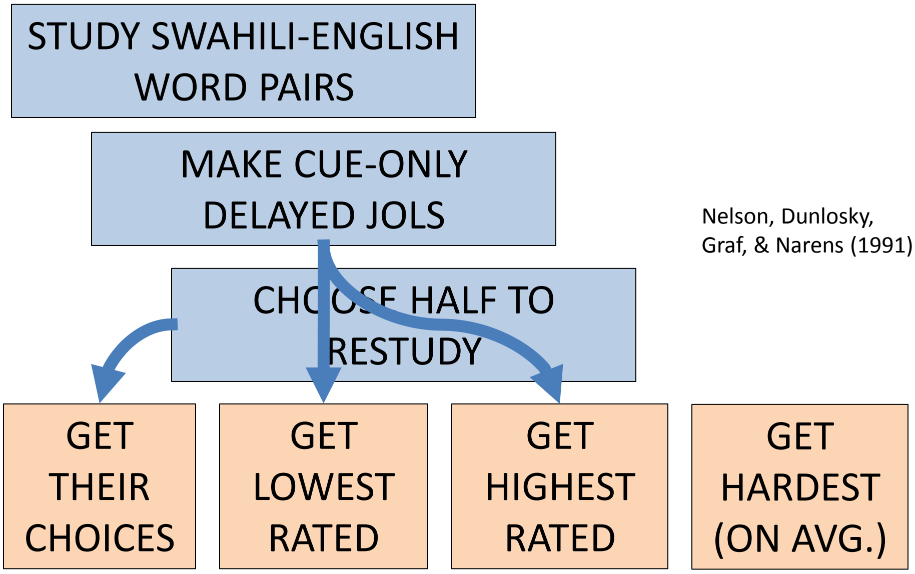


		JUDGMENT CIRCUMSTANCE	
		Cue & Target	Cue Only
TIMING	Immediate	INACCURATE	INACCURATE
	Delayed	INACCURATE	ACCURATE

Outline

- Study Habits
- Metacognition?
  - – Monitoring and control
- Monitoring Learning
  - – Different cues used in different situations
- **Controlling Learning**
  - – **Effectiveness of study decisions**

How effective are we at controlling learning?



STUDY SWAHILI-ENGLISH WORD PAIRS

MAKE CUE-ONLY DELAYED JOLS

CHOOSE HALF TO RESTUDY

GET THEIR CHOICES

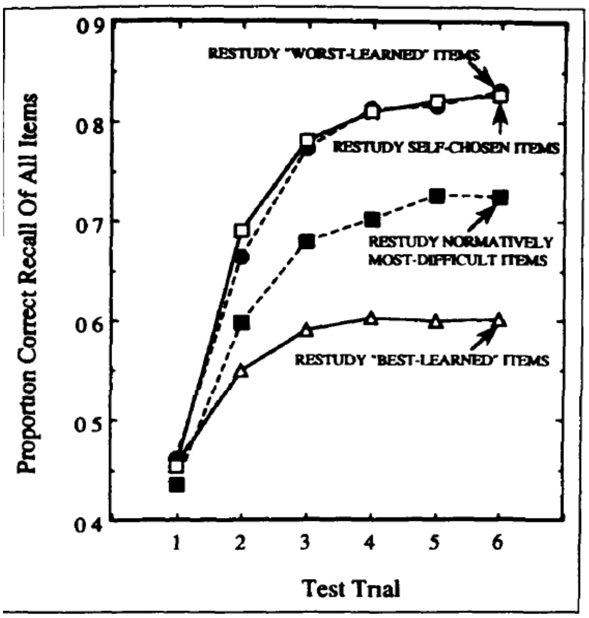
GET LOWEST RATED

GET HIGHEST RATED

GET HARDEST (ON AVG.)

Nelson, Dunlosky,
Graf, & Narens (1991)

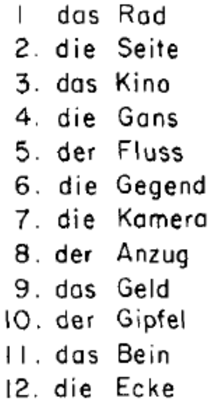
How effective are we at controlling learning?



Learners choose the worst learned items to re-study.

Choice leads to better performance than basing on normative item difficulty or studying "best-learned" items.

How effective are we at controlling learning?



1 das Rad
2. die Seite
3. das Kino
4. die Gans
5. der Fluss
6. die Gegend
7. die Kamera
8. der Anzug
9. das Geld
10. der Gipfel
11. das Bein
12. die Ecke

Seven lists like this.

Tested (and given correct answer) on 2 items on a list before moving to the next list.

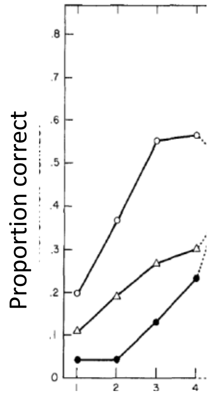
The 2 items are chosen

- Randomly
- By a subject
- By an algorithm that considers prior answers and item difficulty

Repeat this lots and lots of times.

Atkinson (1972)

Effectiveness of choice



Proportion correct

Random selection

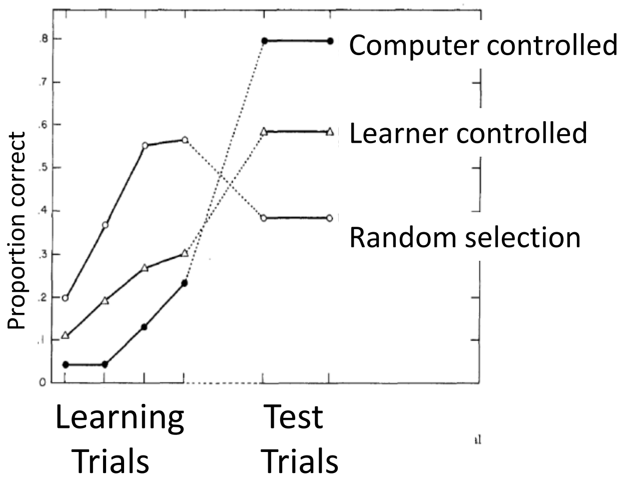
Learner controlled

Computer controlled

Learning Trials

Atkinson (1972)

Effectiveness of choice



Atkinson (1972)

What do learners choose to re-study?

- Across many experiments, learners choose to re-study what they consider to be the worst-learned items.

- Is this the best possible strategy?

- When might it make sense for learners not choose the worst-learned items to re-study?

What do learners choose to re-study?

STUDY WORD PAIRS AND MAKE JOLS

TAKE INITIAL TEST

CHOOSE HALF OF **UNLEARNED** ITEMS TO RESTUDY

4 different experimental groups

HONOR THEIR CHOICES	DISHONOR THEIR CHOICES	GET HIGHEST RATED	GET LOWEST RATED

TAKE FINAL TEST ON ALL UNLEARNED ITEMS

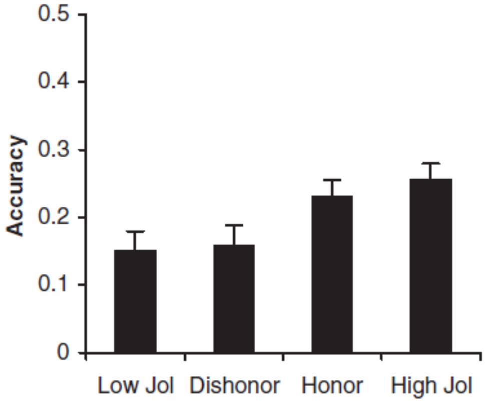
Kornell & Metcalfe, 2006

Results

- Control
  - Chose to study the easiest as-yet-unlearned items
    - The unlearned items with the highest JOLs
  - Higher JOLs for chosen items (average JOL = 35) than unchosen (average JOL = 25)
  - 37 / 48 subjects reported choosing easiest items

Results

- Performance
  - High JOL condition = honor condition
  - Both better than the dishonor and low JOL condition



Metacognition Summary

- Metacognition = monitoring + control
- Metacognitive judgments are made through inferences of available cues.
  - Cues are weighted differently across situations.
  - Monitoring improves dramatically when made delayed with the target absent.
- Learners are effective (but maybe not optimal) at choosing items to re-study to improve performance.
- Learners usually select the worst-learned items to re-study, unless other constraints exist.

Mini Quiz

1. Under what conditions is monitoring most accurate?
2. What are the three types of cues used to infer learning states? Give an example of each.
3. Are learners optimal at selecting items for re-study?